Small Business Innovation Research/Small Business Tech Transfer

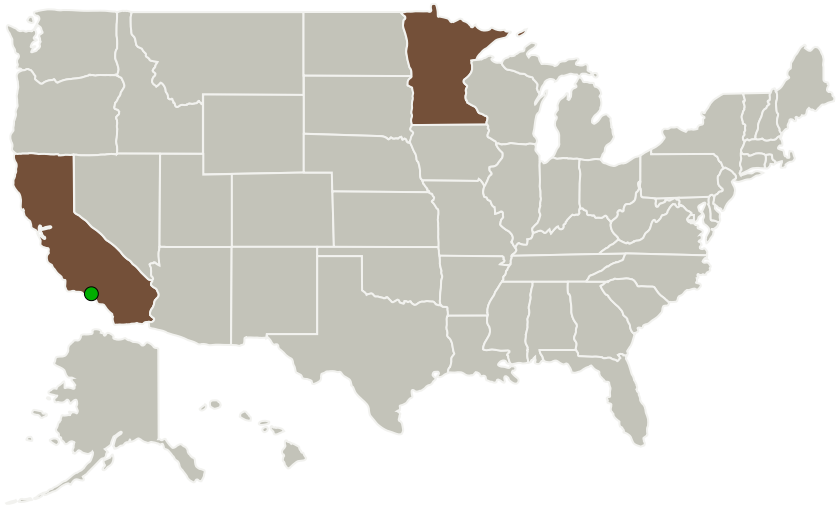
Radiation Hard Multichannel AlN/GaN HEMT for High Efficiency X- and Ka-Band Power Amplifiers, Phase I

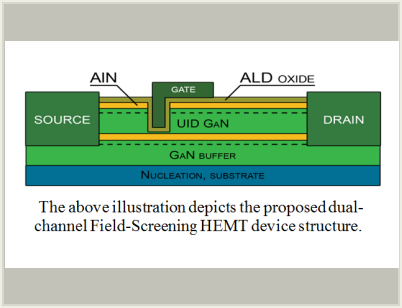
Completed Technology Project (2014 - 2014)

Project Introduction

This project is directed to the development of low-loss, high power-density Aluminum Nitride (AlN)/Gallium Nitride (GaN) heterostructure based transistors for enabling high-efficiency solid state power amplifiers (SSPA) needed for advancing capabilities of future robotic and human exploration spacecraft. The AlN/GaN heterostructure is a particularly attractive system for switch-mode applications due to the extremely high charge density, high electron mobility, high intrinsic breakdown field, and physical thinness achievable and has seen widespread investigation toward solid-state amplifiers in the recent years. However, very few innovations have been proposed with this heterostructure despite its expansive capacity for various creative device concepts. A new patent-pending multichannel AlN/GaN Field Screening High Electron Mobility Transistor (FS-HEMT) design is described. Preliminary experimental results are presented validating design principles that will eliminate current collapse phenomenon at X- and Ka-band frequencies that has plagues traditional HEMT designs and will ultimately deliver a low-loss switch-mode device.

Primary U.S. Work Locations and Key Partners





The above illustration depicts the proposed dual-channel Field-Screening HEMT device structure.

Radiation Hard Multichannel AlN/GaN HEMT for High Efficiency X- and Ka-Band Power Amplifiers Project Image

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Organizations Performing Work	Role	Type	Location
Agnitron Technology	Lead Organization	Industry	Eden Prairie, Minnesota
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Minnesota

Project Transitions

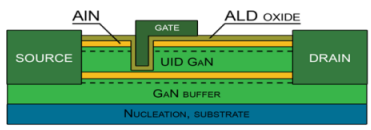
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137421)*

Images



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Project Image
Radiation Hard Multichannel AlN/GaN HEMT for High Efficiency X- and Ka-Band Power Amplifiers Project Image *(https://techport.nasa.gov/image/129882)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Agnitron Technology

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

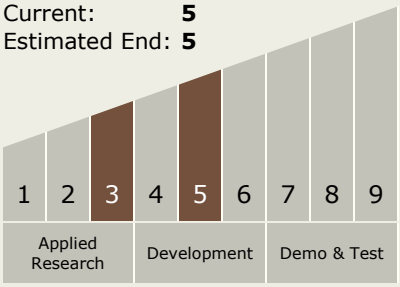
Carlos Torrez

Principal Investigator:

Andrei Osinsky

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.2 Power-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System